Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 1 Conservation of Biological Diversity

Biological diversity, or biodiversity, is the variability among living organisms and the ecological systems of which they are a part. Biodiversity can be measured at the landscape, ecosystem, species and genetic levels. The conservation of biodiversity ensures that all ecosystems maintain their integrity and continue to be productive and to adapt to changing conditions.

Indicator 1.1 Landscape and Ecosystem Diversity

The complexity of landscapes is determined by the number of patches, their characteristics, their size and shape and their connectivity. Ecosystem diversity is the kind and number of ecosystems in an area and the patterns of association of ecosystems with one another and the recurrence of these patterns in a given landscape. The impacts of change in landscapes are expressed through shifts in ecosystem diversity.

Proposed Metric	Data Available	Data Format	Data Source
1.1.1. Percentage and extent of vegetation types relative to historical conditions (at varying scales) **Lever/Gauge**	Statewide coverage LSSF management units USFS By County EUP-LTA (USFS in revision)	Vegetation of Michigan Circa 1800 MIRIS 1978, 1992 & 1998 Landcover IFMAP/GAP 2003 Landcover OI data FIA data MNFI Change Map	MDNR USFS MNFI
1.1.2 Richness and evenness of ecosystems or vegetation types (By age class for forested systems) **Gauge**	Same as above	Same as above	Select diversity index
1.1.3 Richness and evenness of glacial landforms or soil types and index of topographi**c** heterogeneity **Gauge**	Same as above	Landform maps Soils data base	Sources of info: Heikkinen 1998, Lapin and Barnes 1995. Soil SURvey GeOgraphic – SSURGO http//www.ftw.nrsc.usda.gov/ssur_data.html/

Indicator 1.1 Landscape and Ecosystem Diversity

Proposed Metric	Data Available	Data Format	Data Source
1.1.4 Percentage, area, and representativeness of vegetation types in designated protected areas of natural and scientific interest **Lever**	State and Federal lands across Michigan Private Land Trusts	Research Natural Areas (RNA's, PRNA's) Designated Wilderness Natural Areas, State Parks	USFS MDNR National Park Service USFWS Private Land Trusts, e.g. TNC, LTNC
1.1.5 Level of fragmentation, connectivity, shape, size and spatial distribution of vegetation types **Lever**	Statewide coverage LSSF management units USFS	Vegetation of Michigan Circa 1800 MIRIS 1978, 1992 & 1998 Landcover IFMAP/GAP 2003 Landcover OI data FIA data	*www.umass.edu/landeco/research/fragstats/downloads/fragstats_downloads.html *www.umass.edu/landeco/research/fragstats/documents/Metrics?Metrics%20TOC.htm
1.1.6 Connectivity of glacial landforms and/or soil types **Gauge**	Same as above	Soil data data base Quaternary Geology	SSURGO –web site- see above SIRC
1.1.7 Number, area and distribution of unusual or rare vegetation types **Gauge**	Same as above	Natural Community types (not all are available spatially) Other landcover data sets	MNFI www.natureserve.org

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Indicator 1.2 Species Population Diversity

Species diversity refers to the number and relative abundance of species found in an area. The impacts of change in ecosystems are expressed through shifts in species biodiversity.

Proposed Metric	Data Available	Data Format	Data Source
1.2.1 Absolute and relative abundance of habitat types and their importance for focal species.. **Gauge**	Statewide	MI WILD IFMAP/GAP land cover MIS/Focal species Wildlife Conservation Plan	MDNR USFS MDNR Wildlife
1.2.2 Distribution, dispersion and Population trends of focal species. **Gauge**	Depends on species selected	Range maps	University Museums and Herbaria www.natureserve.org
1.2.3 Changes in habitat of focal species. **Lever**	Statewide	Vegetation of Michigan Circa 1800 MIRIS 1978, 1992 & 1998 Landcover IFMAP/GAP 2003 Landcover OI data FIA data	MDNR USFS
1.2.4 Species classified as threatened, endangered, rare or vulnerable and their population sizes and habitat condition **Gauge/Lever**	Not all species statewide	Biotics Species surveys Landcover data above Recovery Plans	MNFI MDNR,USFS, USFWS MDNR, USFS T & E Technical Committees

Indicator 1.2 Species Population Diversity

Proposed Metric	Data Available	Data Format	Data Source
1.2.5 Number of known species that occupy a smaller portion of their former range and the number of known species that occupy a larger portion of their former range **Gauge**	Not all species statewide	Range Maps Computerized data sets	University Museum and Herberia Species references and Experts e.g. Breeding Bird Atlas, Herp Atlas
1.2.6 Species richness of all plants, animals and fungi within representative ecosystems **Gauge**	Number of species found within a given area	Range maps WCR Inventory (non-game fish) MNFI	Floristic Quality Assessment (MDNR) Diversity Index (needs to be selected

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Indicator 1.3 Genetic Diversity

Genetic diversity includes the range of genetic characteristics found within a species and among different species.

Proposed Metric	Data Availability	Data Format	Data Source
1.3.1 Proportion of forest area as plantations using native vs. non-native genotypes **Lever**	State, Fed & Private Present/future or past also		MSU Geneticist – Paul Blazing MDNR Nurseries/Wyman and Brighton FMFMD Cultivation Team NRCS Conservation Districts
1.3.2 Proportion of water bodies using native vs. non-native fish stock genotypes **Lever**	Basin Watershed		MDNR Fisheries Division Intranet Stocking Records Pictured Rocks NLP
1.3.3 Proportion of water bodies with sustainable fisheries produced by stocked vs. natural reproduction **Gauge**	"sustainable" & "stocked reproduction"		MDNR Fisheries Division Intranet Stocking Records WCR Funding – Reuben Goforth – MNFI
1.3.4 Proportion of planted openings on managed lands with native vs. non-native species **Lever**	OI FTPs	Data Base Paper	PRB FMFMD WLD

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 2 Ecosystem Condition and Productivity

Ecosystem condition is a measure of relative freedom from stress and the relative level of physical/biological energy within an ecosystem. Ecosystem productivity refers to the rate of production of organic matter within an ecosystem. This results from interactions between biological components and abiotic factors such as soil, water and climate. Sustainable productivity is dependent upon the ability of ecosystems to recover from or adapt to disturbances; both natural and human induced. A healthy and diverse ecosystem is better able to respond to and recover from changes in its environment.

Indicator 2.1 Incidence of Disturbance and Stress

Ecosystem change is constant. Many of these changes are adaptations to disturbance. Disturbances generally cause ecosystems to revert to earlier successional stages or establish new patterns of succession. Fundamental to the continued health, vitality and productivity of ecosystems are their ability to adapt to the various stresses placed upon them. Disturbances may be part of natural ecological cycles or the result of human activities. Human-induced stress and disturbance include introduced (exotic) species, prescribed burning, fire suppression, populations out of balance with available habitat, pollution and land-use practices. Natural disturbances include native insects, high wind events and fire.

Proposed Metric	Data Availability	Data Format	Data Source
2.1.1 Area and severity of forest stressor **Gauge**	Statewide	GIS ArcView	MDNR-Forest Health Section OI
2.1.2 Area and severity of wind and fire activity **Gauge**	Statewide	GIS Web sites	MDNR; VMS salvage timber sales
2.1.3 Presence, extent and number of invasive exotic species **Gauge**	Impact plot systems, FIA (phase 3) annual damage surveys and planned urban forest health monitoring; streams		USFWS, MDNR, MDEQ, MIPC; Forest Health and USFS-FIA Local FD files
2.1.4 Area and severity of mammalian herbivory **Gauge**	None		
2.1.5 Area and intensity of timber harvest **Lever**	Statewide		CFA Cutting Reports USFS/FIA; MDNR Cutting Reports; OI
2.1.6 Land clearing/urban sprawl **Gauge**			Remote sensing data; USDA?

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Indicator 2.2 Ecosystem Resilience

Resilience is a measure of an ecosystems' ability to maintain its natural range of variability given its disturbance regime and other dynamics. Resilience reflects the persistence of ecosystems and their capacity to respond to changes and disturbances.

Proposed Metric	Data Format	Data Availability	Data Source
2.2.1 Area by vegetation type and age class **Lever**	Various inventory systems for each landowner IFMAP/GAP 2003 landcover.	Limited ownership Statewide	MDNR, USFS, USFWS, TNC MEAD-WESTVACO, FORESTLAND GROUP
2.2.2 Area successfully regenerated by vegetation type **Lever**	Various inventory systems for each landowner IFMAP/GAP 2003 landcover	Limited to ownership Statewide	MDNR, USFS, USFWS, TNC, MEAD-WESTVACO, FORESTLAND GROUP
2.2.3 Ecological function, activity and responses to perturbation within "protected areas" **Gauge**		None available	
2.2.4 Distribution and abundance of top carnivores. **Gauge**	Excel spreadsheet Access db	Regional, by county	MDNR Wildlife Division
2.2.5 Distribution and abundance of mammalian herbivores **Gauge**	Excel spreadsheet Access db	Regional, by county	MDNR Wildlife Division

Indicator 2.2 Ecosystem Resilience

2.2.6 Ratio of exotic invasive plant species to native plant species in natural vegetative communities **Gauge**	ArcView coverage Access db Possible clearinghouse for point locations IFMAP?	EUP T/R/S	MDNR Wildlife Division survey MIPC (Michigan Invasive Plant Council) MDA RCS
2.2.7 Presence of spring ephemerals **Gauge**	IFMAP? Other survey information	Stand level information T/R/S	MDNR Field botanists

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Indicator 2.3 Biomass

Biomass represents the total mass of living organisms inherent in an ecosystem. It is an integrating measure of ecosystem condition (health and vitality of all species and habitat types). Evidence that the condition of habitat types is constant or improving indicates that they are being managed in a sustainable way. In this case, we are measuring forest productivity.

Proposed Metric	Data Format	Data Available	Data Source
2.3.1 Mean annual increment by forest type and age class **Lever**		.	USDA Forest Service FIA MI DNR IFMAP (FMFM)
2.3.2 Net annual growth by forest type and age class for the EUP **Lever**			
2.3.3 Biomass volumes of standing flora. **Gauge**			Same as above Literature search for other vegetative and historical information.

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Indicator 2.4 Ecosystem Structure

Vegetation and other biotic and abiotic materials provide the physical structure within which most organisms live. Ecosystem structure includes the presence and arrangement of these physical structures in three dimensional space. Species richness in some taxa is correlated with ecosystem community structure.

Proposed Metric	Data Format	Data Availability	Data Source
FORESTED ECOSYSTEMS			
2.4.1 Number of super canopy trees **Lever**	OI, IFMAP, FIA Other forest inventory	Compartments on state lands, USFS, Corporate lands, NPS, USFWS, conservancies on their ownerships	MDNR, USFS, USFWS, TNC MEAD-WESTVACO, FORESTLAND GROUP Other conservancies
2.4.2 Snags per area, basal area, mean DBH and decay class **Lever**	IFMAP (in part)	State forest lands	MDNR
2.4.3 Cavities per area by size class **Lever**	Not recorded on state or federal ownerships except incidentally	Sporadic – biologist's files May be a note in OI	MDNR USFS
2.4.4 Coarse woody debris per area, mean DBH and decay class **Lever**	IFMAP, FIA	Statewide	MDNR, USFS
2.4.5 Number of vertical vegetation layers per area **Lever**	IFMAP, FIA	Statewide	MDNR, USFS

Indicator 2.4 Ecosystem Structure

Proposed Metric	Data Format	Data Availability	Data Source
2.4.6 Number and size of tree fall gaps, harvest gaps and maintained wildlife openings per area in northern hardwood ecosystems **Lever**	OI data (for wildlife openings)	Statewide	MDNR, USFS
2.4.7 Tree size: basal area per acre/hectare for different forested communities **Lever**	OI data, FIA	Statewide	MDNR, USFS
2.4.8 Distribution of cliffs, outcrops, sinks and glacial erratics **Gauge**	Quaternary geology? MNFI Biotics, OI data	Statewide (sporadic)	MDNR, MNFI
NON FORESTED ECOSYSTEMS (dunes, bogs, etc.)			
2.4.9 Number of vertical vegetation layers per area **Gauge**	IFMAP, FIA, Special studies in various community types	Statewide	MDNR, USFS, MNFI
2.4.10 Ratio of open water to emergent vegetation in wetlands **Gauge**			

AQUATIC ECOSYSTEMS			
2.4.11 Surface and sub-surface geology of valley segment **Gauge**			UP Valley Segment Classification Data011203_1325 (Ed Baker – Version 1; MI Water Atlas – Institute of Fisheries/Ann Arbor; Hydrology & Recreation on the Cold-Water Rivers of Michigan's UP (Water Information Series Report 4) – US Geological Survey Land and Water Management Division/Inland Lakes Local files
2.4.12 Number of vertical vegetation layers by valley segment **Gauge**			
2.4.13 Surface and sub-surface hydrology of valley segment **Gauge**			
2.4.14 Coarse woody debris per area, mean DBH and decay class **Lever**			
2.4.15 Bathymetric shape of lakes **Gauge**			
2.4.16 Aquatic plant abundance and distribution **Gauge**			

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 3 Water and Soil Conservation

Water and Soil are essential to sustaining the functioning and productive capacity of ecosystems. Water conservation is an important provision of suitable aquatic environments for plants and animals, and for the provision of potable water for humans and wildlife; whereas, soil conservation is the maintenance of the living substrate for forests, shrubs and grasslands.

Indicator 3.1 Water quality

Long term productivity and resilience of habitats, and a potable water supply for humans and wildlife, are dependent upon an abundant and clean water source. In order to ensure that aquatic ecosystems are maintained, policies that address stream crossings, watershed management and riparian areas will help maintain water flow patterns, water levels and water quality.

Proposed Metric	Data Available	Data Format	Data Source
SURFACE WATER METRICS			
3.1.1 Percent of rural/urban land managed for water conservation (watershed quality) **Lever**		Spreadsheets Maps	SIRC
3.1.2 Water chemistry (pH, dissolved O^2, water conductivity, turbidity and water temperatures) and volume flow **Gauge**		Spreadsheets; ACCESS	FD Marquette; FD Newberry; SWQ
3.1.3 Fecal coliform **Gauge**			County Health Dept., DEQ
3.1.4 Nutrients (nitrates and phosphates) **Gauge**			Fish Division
3.1.5 Fish species diversity **Lever**		Data base	FD and SWQ
3.1.6 Benthic species diversity **Gauge**		Data base	FD AND SWQ Procedure 51

Indicator 3.1 Water Quality

Proposed Metric	Data Available	Data Format	Data Source

3.1.7 Number of water crossings per unit area **Lever**	Ranked erosion potential Stream width, and width at high water mark Depth of sand to gravel substrate Width and type of buffer vegetation % canopy over streams	Spreadsheets; data bases VECTOR ACCESS	BMP; DEQ/SWQ
3.1.8 Pesticide residue concentrations in surface water **Gauge**	DEQ/EPA; bioassays on Great Lakes bald eagles; Bioassays on Great Lakes and inland fish	Data bases; spreadsheets	DEQ/SWQ
3.1.9 Area of wetlands **Gauge**	National Wetlands Inventory (NWI); land cover data sets; soil books	Data sets; spreadsheets; books	NWI; FD; NRCS
3.1.10 Surface withdrawals by volume **Lever**			
GROUND WATER METRICS			
3.1.11 Ground Water Recharge Zones **Gauge**	DARCY maps	Maps	
3.1.12 Ground water elevations **Gauge**	DARCY maps	Maps	County Health Dept
3.1.13 Quality of drinking water **Gauge**			County Health Dept; DEQ
3.1.14 Total water wells abandoned due to man-made contaminants **Gauge**			County Health Dept; DEQ
3.1.15 Sub-surface withdrawals by volume **Lever**		Tabular data; text	MSU Water Atlas; DEQ Office of the Great Lakes

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Indicator 3.2 Soil Conservation

The long-term productivity and resilience of forests and other habitats are dependent upon the maintenance of appropriate levels of soil oxygen, nutrients and organic matter. In order to ensure that terrestrial and aquatic ecosystems are maintained and improved, policies must be enacted to provide for specific management practices or the protection of sensitive sites.

Proposed Metric	Data Available	Data Format	Data Source
3.2.1 Area of lands managed for soil conservation (reflects the fragility of the soil on some sites)) **Gauge**	Critical Dunes Act Conservation Reserve Program (CRP) National Wetlands Inventory USDA/MDA Farm Mgt Plans EQUIP FLEP WRP Natural Resource Inventory	Land Use Maps Digital shape file Paper Reports	DEQ – Natural Resources and Environmental Protection Act, 1994 PA 451 USFWS -National Wetlands Inventory ; MI Center for Geographic Information http://www.state.mi.us/webapp/cgi/mgdl/?action-thm MDNR – CRP; http://www.fsa.usda.gov/dafp/cepd/crpinfo.htm CFSA – Consolidated Farm Service Agency USDA, USGS
3.2.2 Soil stability and productivity (pH, soil faunal and fungal activity, soil erosion, degradation indices) **Gauge**	Soil surveys	Paper Digital data FD data base (?)	SIRC (when published) Individual counties www.ftw.nrcs.usda.gov/ssur_data.html MDNR – Fish Division USGS

Indicator 3.2 Soil Conservation

Proposed Metric	Data Available	Data Format	Data Source

3.2.3 Area of vegetated riparian corridors **Lever**	RMZ Natural River Legislation BMPs Bank Legislation	Paper		

NOT CURRENTLY FEASIBLE/MEASUREABLE/RELEVANT(?)

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 4 Ecological Cycles

Ecological cycles are a complex of self-regulating processes responsible for recycling the earth's limited supplies of water, carbon, nitrogen and other elements necessary to sustain life. Understanding the role that local systems play in these global cycles is essential for the development of sound ecosystem management and sustainability.

Indicator 4.1 Carbon cycle

The global carbon cycle represents an important set of processes linking plant and animal communities with climate change. The release or removal of CO_2 to and from the atmosphere impacts on global ecological cycles. Forests, wetlands and water bodies can act as either sinks (a vigorous and growing forest) or sources for atmospheric carbon, depending on whether they are primarily storing carbon or releasing it. Knowledge of the influence of natural disturbances and human intervention on this role can indicate the type of forest practices required for sustainable management.

Proposed Metric	Data Available	Data Format	Data Source
4.1.1 Area of forest permanently, semi-permanently, or temporarily converted to non-forest land use	Great Lakes Forest Alliance	C&I/Report on line	Great Lakes Forest Alliance
4.1.2 Carbon pool in forest products	Great Lakes Forest Alliance	C&I/Report on line	Great Lakes Forest Alliance
4.1.3 Carbon pools in soils	Great Lakes Forest Alliance	C&I/Report on line	Great Lakes Forest Alliance
4.1.4 Amount of fuels consumed	Cannot be measured easily		Needs more research
4.1.5 Fuelwood consumption/atmospheric			

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Indicator 4.2 Hydrological Cycle

Hydrological cycles involve the movement of water from the atmosphere to the surface of the earth in the form of precipitation; from soils to streams to lakes; and from soil to plants to the atmosphere. Because of their vast area in the EUP, forests play a major role in Great Lakes hydrological cycles. Changes in forestland cover and management influence the storage and movement of water and the timing of the various components of the hydrological cycle. The forest can regulate the flow of water into lakes and wetlands directly or by influencing stream and river flows. Consequently, sustainable forest management plays a crucial role in contributing to the regulation of the hydrological cycle.

Proposed Metric	Data Available	Data Format	Data Source
4.2.1 Number, distribution and acres of impoundments affected by natural and artificial water control structures **Gauge**	MDNR Aerial photos MDNR Operations Inventory data Fish Division Surveys	Photos Surveys	Aerial photos; operations inventory; Fish Division status and trends surveys
4.2.2 Surface area of lakes and wetlands; total flow data for rivers and streams **Gauge**	Acreage of inland lakes Approximate acreage of various wetland types, flow data (USGS)	Databases	DEQ Surface Water Quality personnel USFS/MDNR operations inventory data Marquette NPDS permits MDEQ Lansing IFMAP/GAP land cover layer

Indicator 4.2 Hydrological cycles

Proposed Metric	Data Available	Data Format	Data Source

4.2.3 Changes in Great Lakes water levels **Gauge**	Lakes Superior, Michigan and Huron – daily levels compared w/last year's level and daily levels compared with monthly minimum and maximum mean levels		www.ucsusa.org/greatlakes/glimpactover www.glerl.noaa.gov/data/now/wlevels/ NOAAA; Tonello layers Web site IFMAP
4.2.4 Annual precipitation **Gauge**	Historical averages for EUP precipitation normals Monthly and annual total precipitation Monthly and seasonal (April – Sept) precipitation # of day w/precipitation at varying levels	Tables: Probability Distribution Function (PDF)	For historical data: http://climate.geo.msu/edu/e-upper.html For EUP locations: http://www5.ncdc.noaa.gov/climatenormals/clim81/MInorm.pdf (Tonello has data layers)
4.2.5 Groundwater withdrawals **Gauge**	Limited data. Population studies (multiply population dependent on ground water x 100 gallons per day); MDEQ domestic, commercial and agricultural use figures		MDEQ, Water Division
4.2.6 Great Lakes water withdrawals **Gauge**	IJC reviews proposals for large scale consumptive use removals		MDEQ, Office of the Great Lakes (domestic use – Marquette; commercial and agricultural use – Lansing)
4.2.7 Acres of artificially created surface **Gauge**	MDNR		IFMAP – land cover layer

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 5 Uncommon or Rare Natural Features

Identification and recognition of uncommon geological sites, plant and animal species, and ecological communities can make a difference between success and failure at sustaining our heritage and protection of natural systems over the long run.

Indicator 5.1 Uncommon or rare vegetation types

Proposed Metric	Data Available	Data Format	Data Source
5.1.1 Type, area, distribution and quality of uncommon or rare vegetation types. Size and distribution of uncommon or rare habitat types **Gauge**			OI MNFI Biotics USFS Land Conservancies IFMAP GAP Landcover
5.1.2 Type, area, distribution and representativeness of uncommon or rare vegetation types and their protection status (i.e. protected areas Natural areas, Old growth, Wild and Scenic Rivers, State Parks **Gauge**			OI MNFI Biotics USFS Land Conservancies IFMAP GAP Landcover
5.1.3 Type, area and distribution of uncommon or rare vegetation types under active management **Lever**			OI FMFM unit offices MNFI Biotics IFMAP GAP Landcover FMFMD Forest Stewardship Program Coordinator USFS Land Conservancies

Indicator 5.1 Uncommon or rare vegetation types

Proposed Metric	Data Available	Data Format	Data Source
5.1.4 Availability of critical fisheries habitat to support natural reproduction **Gauge**			Local files of on-site inspections
5.1.5 Miles of undeveloped Great Lakes shoreline, inland lakes and water courses **Gauge**	Miles of undeveloped Great Lakes shoreline, inland lakes and water courses		LAMP plans for Great Lakes Township Zoning

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 5 Uncommon or Rare Natural Features

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Indicator 5.2 Uncommon or rare species

Proposed Metric	Data Available	Data Format	Data Source
5.2.1 Population levels, habitat distribution and changes over time of selected uncommon or rare species (species will need to be selected) **Gauge**	For some select species e.g. T&E and SC. For certain grassland birds Forest habitat types and GLO available statewide across all ownerships		MDNR. MNFI, USFWS, USFS, DEQ FD Marquette Research Forest habitat type maps MIWild database MIRIS, IFMAP, Breeding Bird Survey (BBS), Partners in Flight (PIF), Breeding Bird Atlas (BBA) (other species atlases
5.2.2 Number of species classified as threatened, endangered, rare or vulnerable relative to the total number of known species by taxa **Gauge**			MDNR USFS SVE database MNFI

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 5 Unique Natural Features

Identification and recognition of unique geological sites, plant and animal species, and ecological communities can make a difference between success and failure at sustaining our heritage and protection of natural systems over the long run.

Indicator 5.3 Geophysical and Hydrophysical Features

Proposed Metric	Data Format	Data Availability	Data Source
5.3.1 Number, location and protection status of physical features and landforms (karsts, dunes, rock outcrops, eskers, drumlins, moraines, fossil beds) **Gauge**	Shapefile format. Full attribution	Data is incomplete (See NFI Metadata). What exists is very good.	http://www.caves.org/conservancy/mkc/ Michigan Natural Feature Inventory-Biotics RMAP-1982 Quaternary Geology USFS SVE
5.3.2 Number of unique water features: aquifers, artesian wells, springs, waterfalls, recharge zones. **Gauge**	No digital data available		Michigan Water Atlas Leverett, F., 1906. Flowing well Districts in the eastern part of the northern peninsula of Michigan, in Fuller, M. L., USFS Water Supply Paper 160 Allen, W. B., 1977. Flowing wells in Michigan 1974 USFS Water Information Series Report 2

Indicator 5.3 Geophysical and Hydrophysical Features

Proposed Metric	Data Format	Data Availability	Data Source

5.3.2 (contd) Number of unique water features **Gauge**			Leverett, F., 1906. Flowing Wells and municipal water supplies in the southern portion of the southern peninsula of Michigan, Water Supply Paper 182 Leverett, F., 1907. Flowing wells and municipal water supplies in the middle and northern portion of the southern peninsula of Michigan, Water Supply Paper 193

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 6 Social / Cultural:

The Eastern Upper Peninsula Eco-region is a predominantly rural and natural resource rich region of Northern Michigan. This has provided a context for the social-cultural values of communities that make the sustainability of resources essential to the social and

cultural fabric of the region. People who live in the eco-region point to the importance of their lifestyles and the strong connection with the land.

Indicator 6.1 Stability of land use

Proposed Metric	Data Available	Data Format	Data Source
6.1.1 Percentage of lands that are under alteration by vegetative type **Gauge**	Zoning variances awarded per year	Sizes and locations of variances by county—paper format: Compare with LTA-related (i.e., Albert) designations	County assessors office for variances; SIRC for habitat classifications DEQ/Land and Water Mgt., DNR
6.1.2 Area of lands under restoration by vegetative type **Gauge**	Habitat restoration projects completed per year.	Restoration project events & locations by county (point source)	The Nature Conservancy, Little Traverse Conservancy DEQ, MDOT, MDNR Forest Land Enhancement Program (FLEP)
6.1.3 Amount of change of ownership **Gauge**	Land parcel sales per year	Paper or electronic file format	County assessors office
6.1.4 Amount of ownership fragmentation and parcelization of land **Gauge**	Land parcel splits per year	Paper or electronic file format	County assessors office

Indicator 6.1 Stability of Land Use

Proposed Metric	Data Available	Data Format	Data Source

6.1.5 Traditional non-profit uses for cultural forest products (e.g.berries, syrup, mushrooms, black ash, cattails, etc.) **Gauge**	Estimated number of residents and visitors who participate in gathering activities.	Qualitative interviews of EUP residents and visitors Permits	USFS & MDNR Use/Special Use Permits *The use and importance of natural resources for gathering and harvesting in Michigan's Eastern Upper Peninsula (1998)* by Christina Kakoyannis—Master's thesis
6.1.6 Number and size of forested parcels that have been added to or removed from the Commercial Forest Program **Gauge**	Statewide coverage available by county	File copies available GIS	MDNR FMFMD. Private Lands Section, Commercial Forest Asst.

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Indicator 6.2 Place for nature and scientific study

Proposed Metric	Data Availability	Data Format	Data Source
6.2.1 Area and vegetation types in areas of natural and scientific interest **Gauge**		Biotics, RNAs/PRNAs, Natural Areas, Dukes Exp. Forest	MNFI USFS MDNR
6.2.2 Number of educational and recreational opportunities **Gauge**	Gilette Sand Dune Visitor Center, Gerald E. Eddy Discovery Center, DEQ, Cranbrook Institute of Science, Quincey Mine Tour, Copemish Mine Tour Tahquamenon Falls, Pictured Rocks NLP	Web sites Chambers of Commerce Interpretive exhibits Tours	http://www.uptravel.com http://www.exploringthenorth.com/mich/mich.html http://www.cranbrook.edu/ http://www.quincymine.com/ Parks & Recreation Division
6.2.3 Presence of natural features, plant species and wildlife species important to the identity of area **Gauge**		OIPC Biotics	MDNR

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 6 Social /Cultural:

The Eastern Upper Peninsula Eco-Region is a predominantly rural and natural resource rich region of Northern Michigan. This has provided a context for the social-cultural values of communities that make the sustainability of resources essential to the social and cultural fabric of the region. People who live in the eco-region point to the importance of their lifestyles and the strong connection with the land.

Indicator 6.3 Archaeology and History
Resource management planning takes into account the identification and protection of known unique or significant Native American, Euro American, social, cultural and or spiritual sites.

Proposed Metric	Data Available	Data Format	Data Source
6.3.1 Archaeological Site Potential. **Gauge**	Currently only northern Lower Michigan. By 2004 the map will be expanded to the Upper Peninsula of Michigan.	A raster based map derived from a multi-criteria model which depicts the potential for a prehistoric archaeological site to be present.	This data is currently available to DNR staff through an intranet based GIS mapping system. State archeologist OI
6.3.2 Presence of a known archaeological site (more weight can be given to sites that are on the National Register of Historic Places, this register includes prehistoric sites as well). **Gauge**	Statewide for areas that have been surveyed by an archaeologist (whether professional or amateur).	A section level map is available for the state which contains the presence/absence of archaeological sites. At the State Historic Preservation Office detailed maps (including reports and other sources of information) are maintained of archaeological sites. Hinsdale's *Archaeological Atlas of Michigan* also contains information (although it may be in accurate/limited) about archaeological site locations.	SHPO and or a historical/archaeological resource plan State archeologist OI

Indicator 6.3 Archaeology and History

Proposed Metric	Data Available	Data Format	Data Source
6.3.3 Presence of an area(s) of Historical/Cultural Significance (many times these areas may show no visible signs of their significance, e.g. a Native American Indian trail corridor where the trail is no longer visible, or a spot at which a meeting or discovery took place). **Gauge**	Statewide although some information is sporadic.	Areas in and around historic markers or known historic sites. MNFI has created maps of Historic period Native American Indian trails and settlements which were recorded by early surveyors. Various historic accounts and or local markers (also see matrix above for sources).	A database of historic markers is available on-line at: www.michmarkers.com (maintained by Jim Brennan of Emmett, Michigan). MNFI/SHPO and or a historical/archaeological resource plan Bureau of History
6.3.4 Presence of spiritual/ceremonial activities. **Gauge**	Sporadic availability.	Likely found in ethnographic or historic accounts. Local tribal leaders/elders will also be a great source for this type of information. Some of these areas may be part of or listed as archaeological sites.	Local knowledge SHPO

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Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 6 Social / Cultural:

The Eastern Upper Peninsula Eco-Region is a predominantly rural and natural resource rich region of Northern Michigan. This has provided a context for the social-cultural values of communities that make the sustainability of resources essential to the social and cultural fabric of the region. People who live in the eco-region point to the importance of their lifestyles and the strong connection with the land.

Indicator 6.4 Presence of local planning efforts for the sustainability of natural resources and communities

Proposed Metric	Data Available	Data Format	Data Source
6.4.1 Percent of townships addressing sustainability of natural resources and communities. **Gauge**	Available for each township in state.	Township zoning rules. Format would vary by township, mostly paper format	Contact each township individually. MDNR has list of townships and contacts.
6.4.2 Percent of counties addressing sustainability of natural resources and communities. **Gauge**	Available for each county in state.	Format would vary by county, mostly paper format	Contact each county individually. MDNR has list of county contacts.
6.4.3 Presence of regional or watershed area planning efforts **Gauge**	Coverage would depend on specific projects.	Data format varies by project.	UP Regional Planning www.eup-planning.org; Lex Cheneaux Economic Forum; Tip of the Mit Watershed Council; Central Lake Superior Watershed Partnership; other watershed organizations; MDNR.

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 7 Spiritual

Spiritual values are personal feelings and sentiments that natural resources engender to the human spirit and are a reason for sustaining the landscape to provide those experiences. Because the essence here is personal and to a large degree intangible, the indicators pertain to the features of the ecosystem which are most evocative to the senses and secondly, which pertain to the ability of people to use those resources.

Indicator 7.1 Undeveloped natural resources

Proposed Metric	Data Available	Data Format	Data Source
7.1.1 Size and distribution of natural and 'special management' areas and allowed use of those areas **Gauges**	Natural and special management area boundaries		MDNR – Natural Areas boundaries, Special Management Areas USFS – RNAs PRNAs, designated wilderness MI Nature Association The Nature Conservancy Biodiversity Team
7.1.2 Road and motorized trail density **Lever & Gauge**	County and statewide		MIRIS – county, state, some trails MDNR – ORV tech, Recreation Specialist
7.1.3 Density and distribution of dwellings and commercial structures **Lever & Gauge**			Census Zoning 1991 TM imagery - LANDSAT
7.1.4 Measure / monitor distribution of undeveloped areas in populated areas **Gauge**			IFMAP GAP

Spiritual values are personal feelings and sentiments that natural resources engender to the human spirit and are a reason for sustaining the landscape to provide those experiences. Because the essence here is personal and to a large degree intangible, the indicators pertain to the features of the ecosystem which are most evocative to the senses and secondly, which pertain to the ability of people to use those resources.

Indicator 7.2 Aesthetics

Proposed Metric	Data Available	Data Format	Data Source
7.2.1 Area and distribution of "secluded" natural resources. **Gauge**		Data base Web sites	PRB MDNR Michigan Tourism Bureau
7.2.2 Presence of litter or trash dumped on public land **Lever**			Clean forest.org Ada Takacs – Adopt-a-Forest Adopt-A-Highway
7.2.3 Number of designated access opportunities to view scenic vistas and/or wildlife **Gauge**			MI Wildlife Viewing Guide MDOT-Designated scenic roads/turnouts PRB MDNR Recreation Natural Rivers, Natural Areas, etc.

Indicator 7.2 Aesthetics

Proposed Metric	Data Available	Data Format	Data Source
7.2.4 Miles of road by use class, distribution and density in EUP	Road systems in EUP	Maps	MDNR local units and Lansing FMFMD; County Road Commissions DOT
7.2.5 Visual management			OI – Travel Influence Zones
7.2.6 Emotional/intrinsic values (Are my needs being met?)		Surveys	Research projects Campground Registrations

Criterion 8 Recreation

An activity pursued during leisure time and by free choice that provides its own satisfaction.

Indicator 8.1 Hunting, Trapping and Fishing

Proposed Metric	Data Available	Data Format	Data Source
8.1.1 User days/ activity **Gauge**	Reports; surveys	Paper; pdf files; web site	Wildlife and Fish Divisions Research Section; MDNR web site
8.1.2 Satisfaction levels **Gauge**	Reports; surveys	Paper; pdf files; web site	Wildlife and Fish Divisions Research Section; MDNR web site
8.1.3 Population health by species **Gauge**	Reports; surveys	Paper; pdf files; web site	Wildlife and Fish Divisions Research Section; MDNR web site
8.1.4 Population density by species **Lever**	Reports; surveys; press releases	Paper; pdf files; web site	Wildlife and Fish Divisions Research Section; MDNR web site
8.1.5 Harvest number by species **Lever**	Reports; surveys; press releases	Paper; pdf files; web site	Wildlife and Fish Divisions Research Section; MDNR web site
8.1.6 Number and distribution of shooting ranges **Lever**	By unit and statewide	Web site; paper format	MDNR web site; LED Safety Section
8.1.7 Amount of Commercial Forest (CF) lands, changes in status **Gauge**	Available statewide	Booklet form; web site	District CFM Specialist; FMFMD Lansing

Indicator 8.1 Hunting, trapping and fishing

Proposed Metric	Data Available	Data Format	Data Source
8.1.8 Law Enforcement activity- number of warnings, summons, arrests per activity **Gauge**	Bi-weekly report	EXCEL format	District Law Supervisor
8.1.9 Number of safety training opportunities per activity **Lever**	Schedules for ORV, snowmobiled, hunting, boating safety	Web site; paper list	MDNR web site, District Law Supervisor, DNR field offices, LED Lansing
8.1.10 Accident trends per activity per season **Gauge**	District and Statewide	Paper reports, e-mail. press releases	MDNR web site, MSP, LED Lansing

Criterion 8 Recreation: An activity pursued during leisure time and by free choice that provides its own satisfaction.

Indicator 8.2 Designated Trails – motorized and non-motorized (hiking, ORV, snowmobile, skiing, equestrian)

Proposed Metric	Data Available	Data Format	Data Source
8.2.1 Infrastructure and resources available for trail maintenance **Lever**	**ORV** All ORV Trails **State Park Trails** All trails in each State Park were inventoried including the trail conditions. **Non-motorized trails**-State, Federal, Local and private land trails **Snowmobile-**Due to constantly changing nature of the snowmobile trails, any data here would vary on an hourly basis.	**ORV** Trail by trail assessment. Criteria established to rate ORV trails in good, fair, or poor condition. **Non-Motorized-**little or no data readily available; data availability may vary by jurisdiction **Snowmobile**-Limited data available would be in the form of FMFMD trail inspection reports and user reports; Michigan Snowmobile Association (MSA) Trail Conditions Hotline Reports; multitude of trail condition websites.	**ORV** "Mich. State Forest Off-Road Vehicles Trail and Route Assessment and Estimate of Average Annual Maintenance Costs" 1997 FMFM/MSU **State Park Trails** All trails were inventoried by GPS and the data compiled by PRB Stewardship Program. **North Country Trail Snowmobile-Management Unit; MSA; various websites**. Federal and local units of government
8.2.2. User days per activity **Gauge**	**Linear State Parks** The 4 linear State Parks have some data available on user trends. **Snowmobile-**Dealer and Manufacturer surveys; additional trail counters	**Linear State Parks** The data is from surveys, report cards, past permit sales records. **ORV** Survey indicates ORV use, type, and activity. **Snowmobile-**UP Trail counts	**Linear State Parks** Kal-Haven Trail State Park, White Pine Trail State Park, Hart-Montague Trail State Park, Van Buren Trail State Park **ORV**"Mich. Licensed ORV Use and Users" 1998-98 FMFM/MSU Federal and local units of government

Indicator 8.2 Designated Trails – motorized and non-motorized (hiking, ORV, snowmobile, skiing, equestrian)

Proposed Metric	Data Available	Data Format	Data Source
8.2.3 Miles of trail systems by trail ownership and management type **Lever**	**State Park Trails** All trails in each State Park. **State Forest Pathways** **North Country National Scenic Trail** **Pathways** **Snowmobile Trails** **Snowmobile Trails**	**State Park Trails** GPS database GPS data for entire system; International Snowmobile Manufacturers Assoc and American Council of Snowmoble Associations (ISMA and ACSA) has user trend data	**State Park Trails** All trails were inventoried by GPS and the data compiled by PRB Stewardship Program. 1999-2001 DNR/PRB **State Forest Pathways** All pathways listed in Mich. Parks and Rec. Guide indicating distance and activity. **Rails to Trails** Conservancy publishes brochure listing all trails by distance, surface, activity. **North Country Trail** Trail Assoc. has gathered a GPS database on all their trails and produces brochures and detailed maps. **Snowmobile Trails** FMFM and Individual Club/ Sponsors produce snowmobile trail maps; DNR MIRIS database **Federa**l, State, Local Unit government agencies; **Nature Preserves** and Conservancies
8.2.4 Percentage of stream and wetland crossings complying with BMPs, laws and policies. **Gauge**	Protocol established to collect data; Stream crossing buffer zones	Data may be available or collectable, but not currently compiled	Federal, State, Local Unit government agencies

Indicator 8.2 Designated Trails – motorized and non-motorized (hiking, ORV, snowmobile, skiing, equestrian)

Proposed Metric	Data Available	Data Format	Data Source
8.2.5 Number of safety training opportunities per activity **Lever**	**ORV** Department of Education administers ORV Safety Training. **Snowmobile** Department of Natural Resources, Law Division administers Snowmobile Safety Training. Classes conducted by Conservation Officers; County Sheriff Depts; Volunteer Instructors. DNR, LED tracks data on classes offered and number of students trained.	**ORV** Number of training classes is based on demand. **Snowmobile** Number of training classes**;** number of students trained; number of volunteer instructors available and new instructors trained	Department of Ed DNR LED; County Sheriff departments
8.2.6 Accident trends per activity per season **Gauge**	**ORV** Police Agencies and DNR Law compile data on ORV accidents. **Snowmobile** DNR Law compiles snowmobile FATAL accident data. MSP compiles data on all snowmobile accidents based on reports provided by investigating officers. **State Park Trails** Each park would complete incident reports on trail accidents but there is no central database.	MSP has ORV and Snowmobile Accident data in their computer system, based on UD-10s submitted.	Michigan State Police DNR, LED and FMFMD DNR Parks and Rec Bureau Upper Peninsula Emergency ManagementServices/Marquette 1-800-562-7849

Criterion 8 Recreation

An activity pursued during leisure time and by free choice that provides its own satisfaction.

Indicator 8.3 Nature Appreciation and Education

Proposed Metric	Data Available	Data Format	Data Source
8.3.1 Area of EUP by vegetation type, age class and ownership **Gauge**	Age class – not available for all Ownerships Vegetative cover type – limited Ownership – readily available	Maps	National Park Service Seney Natl. Wildlife Refuge MDNR Divisions Professional Societies Nature Conservancies Universities/Colleges
8.3.2 Miles of public Great Lakes shoreline, inland lakes and water courses **Gauge**	Shoreline miles by ownership		MDNR - SIRC PRB – Harbor Guide
8.3.3 Percentage, area and representativeness of vegetative types in areas of natural and scientific interest **Gauge**			National Park Service Seney Natl. Wildlife Refuge MDNR Divisions Professional Societies Nature Conservancies Universities/Colleges
8.3.4 User days/activity **Gauge**	Seney NWR – data on wildlife viewing and educational programs Hiawatha NF –user day data Program attendance from state parks is available		Same as above

Indicator 8.3 Nature Appreciation and Education

Proposed Metric	Data Available	Data Format	Data Source
8.3.5 Number of unique species observation opportunities **Gauge**		Web sites	MDNR "Watchable Wildlife" USFWS USFS USFS/NLP Whitefish Pointe web site Northern Birding.com Seney NWR
8.3.6 Eco-tour opportunities **Gauge**		Web sites brochures	EUP Nature Tourism Alliance, Northern Initiatives, bholland@niupnorth.org

Criterion 8 Recreation

An activity pursued during leisure time and by free choice that provides its own satisfaction.

Indicator 8.4 Special Scenic Sites

Proposed Metric	Data Available	Data Format	Data Source
8.4.1 Size and distribution of natural and 'special' areas and their allowed use **Gauge**	Plans Maps Acreages Uses	Paper Maps SIRC data bases Web sites	MDNR Nature Conservancies Michigan Nature Assn. Michigan Natural Areas Council Hiawatha National Forest Seney National Wildlife Refuge MDNR Parks & Rec Bureau Michigan Natural Features Inventory
8.4.2 Miles of designated scenic routes **Gauge**	Viewing/tour routes Private vendor travel schedules	Brochures Web sites	MDNR Travel Michigan www.michigan.org Chambers of Commerce Local web sites for area of Interest, e.g. www.stignace.com www.visitnewberrymi.org

Indicator 8.4 Special Scenic Sites

Proposed Metric	Data Available	Data Format	Data Source
8.4.3 Number of designated viewing areas **Gauge**	Wildlife viewing areas Scenic waterfalls Wilderness areas	Web sites SIRC Map overlays Brochures	USFS - Michigan Wildlife Viewing Guide MDNR MDOT web site, www.michigan.gov/mdot MSU Extension-UP www.msue.msu.edu/msue/ctyentpg/reg_up.html UPTRA – www.uptravel.com Land Information Access Association ww.liaa.org/upvision

Criterion 8 Recreation

An activity pursued during leisure time and by free choice that provides its own satisfaction.

Indicator 8.5 Camping – Includes dispersed and designated sites

Proposed Metric	Data Available	Data Description & Format	Data Source
8.5.1 Number, type and distribution of campground facilities- rustic, modern, semi-modern, cabins **Gauge**	State Forest CG- Statewide State Parks CG- Statewide National Forest CG National Parks Local Public CG Commercial CG	Pdf format DEQ/MSU Website	SFC-Program Database; Parks and Rec Bureau NF District Offices DEQ/Health Department/MSU website- http://www.tourismcenter.msu.edu DEQ/Health Department Recreational Vehicle Camping: http://www.michcampgrounds.com/ http://www.marvac.org/
8.5.2 Number of campsites by type in campgrounds **Gauge**	Same as above	Same as above Various formats	Same as above MSU Michigan Travel, Tourism, Recreation Resource Center website: http://www.tourismcenter.msu.edu http://www.michcampgrounds.com/ http://www.marvac.org/
8.5.3 User days by campground and campsite **Gauge**	SF, NF, SP-Data available Data also available for Local Public and Commercial Campgrounds	Various formats	Same as above

Indicator 8.5 Camping – Includes dispersed and designated sites

Proposed Metric	Data Available	Data Format	Data Source
8.5.4 Number of dispersed camps per year **Gauge**	SFCG-Data not currently available NF Camping-Some data available for "regulated" dispersed camping sites Not applicable to State Park, Local Public and Commercial Campgrounds	Various formats	NF District Offices MSU studies by Dr. Charles Nelson
8.5.5 Environmental impact of camping Benchmarks: -Soil erosion from human use -Trash presence -Carrying capacity of facility vs. overuse **Gauge**	Limited data available; primarily campground inspections	General observations and campground inspections	Appropriate campground managers. Comments on registration envelopes from campgrounds

SF = State Forest; NF = National Forest; SP = State Park

Criterion 8 Recreation

An activity pursued during leisure time and by free choice that provides its own satisfaction

Indicator 8.6 Water Recreation – motorized and non-motorized (including swimming, scuba diving, kayaking, etc.)

Proposed Metric	Data Available	Data Format	Data Source
8.6.1 User days per activity (power/sail boating, jet-skis, canoes, rafting/tubing, kayaking, swimming, snorkeling, fishing, water skiing, boat races, cruise ships, sail boarding, etc) **Gauge**	Harbor boat counts; campground registrations/surveys; marina reservation information	Monthly paper reports from harbors/marinas FMFMD camping data base County BAS data GIS (PRB in progress)	MDNR/PRB MDNR FMFMD MDNR web site US Park Service
8.6.2 Number of water access sites and boat slips by type and capacity for watercraft and available amenities **Gauge**		County BAS data GIS (PRB in progress Harbor & Boat Directory) ACCESS data base	MDNR/PRB MDNR FMFMD MDNR web site PRB – Michigan Recreational Boating Information System (MRBIS)
8.6.3 Change in status of water body designation and use **Lever**	Included in MRBIS directory MDNR Director's Orders Fishing Digest	ACCESS data base Paper format; Digests	PRB – MRBIS MDNR web site; digests
8.6.4 Number of safety training opportunities per activity **Lever**	Lists of classes available	Paper Web sites	MDNR – LED; local schools; local sheriff's departments MDNR web site American Canoe Assn.com for canoeing and kayaking

Indicator 8.6 Water Recreation – motorized and non-motorized (including swimming, scuba diving, kayaking, etc.)

Proposed Metric	Data Available	Data Format	Data Source

8.6.5 Accident trends per activity per season **Gauge**	US Coast Guard Reports County sheriff's reports MSP reports	BARD – Boating Accident Reporting Database Paper files	USCG www.uscgboating.org County sheriff's department MSP posts

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 8 Recreation

An activity pursued during leisure time and by free choice that provides its own satisfaction

Indicator 8.7 Diversity of recreational opportunities: the availability of different ways for people to recreate on the landscape

Proposed Metric	Data Available	Data Format	Data Source
8.7.1 Availability of recreational activities by type i.e. lakes, rivers, forest, parks **Gauge and/or lever**	Number of lakes, rivers, streams, parks, campgrounds, hunting acres. Little or no data for berry picking, bird watching, mushrooming, etc.	Various brochures, pamphlets; data base; overlays for state lands; digest	FMFMD, PRB, USDA/USFS, MSU, National Park Service, local units of government; PRB Boating Guide, Michigan Trail Atlas; hunting/fishing digests; private land/public hunting lists
8.7.2 Universal (barrier free) access to facilities **Gauge and/or lever**	ADA data is available but is not centralized	Various; basically ADA accessible or not	MDNR, USDA/USFS, MSU, USFWS; individual owners for local public, commercial and private campgrounds and parks
8.7.3 Quality and satisfaction of recreational experience (would LED activity indicate quality?) **Gauge**	Not readily available. Most likely gained through surveys and studies; licensing and survey data; campground envelope comments	Surveys; data base; questionnaires	Federal, state and local units of government; web sites; FMFMD unit offices; Wildlife and Fish Divisions

Indicator 8.7 Diversity of recreational opportunities: the availability of different ways for people to recreate on the landscape

Proposed Metric	Data Available	Data Format	Data Source
8.7.4 Seasonally adjusted number of participants **Gauge**	Campground data; snowmobile trail data; fishing, hunting data	Data bases, web sites data, digests, surveys	State and national forests; state parks; public and commercial campgrounds; FMFMD unit offices; web sites

Criterion 9 Ownership Patterns

The pattern and distribution of ownership and use of lands in the Eastern Upper Peninsula (EUP), plays a role in sustainable resources. Land ownerships can affect management options, resource demand and fragmentation. The success of sustainable management of Michigan's resources depends on making connections across disciplines, interest, boundaries and landscapes.

Indicator 9.1 Ownership types (the distribution and area of land by owner)

Proposed Metric	Data Available	Data Format	Data Source
9.1.1 Percent of public and private ownership in EUP **Gauge**	Acreage per county; acres for state owned land; acreage for federal lands; local land ownership	LOTS, data bases	MI Assn. of Counties, MSU, MDNR, NRCS, USFS, local units of government
9.1.2 Changes in ownership by acres **Gauge**	Same as above	Same as above	Same as above
9.1.3 Distribution of ownership in the EUP by acres **Gauge**	Same as above	Same as above Maps	Same as above

Criterion 9 Ownership Patterns

The pattern and distribution of ownership and use of lands in the Eastern Upper Peninsula (EUP), plays a role in sustainable resources. Land ownerships can affect management options, resource demand and fragmentation. The success of sustainable management of Michigan's resources depends on making connections across disciplines, interest, boundaries and landscapes.

Indicator 9.2 Stewardship

Stewardship is the practice of carefully managing land usage to ensure natural systems are maintained or enhanced for future generations; to preserve the capacity of the land for self-renewal.

Proposed Metric		Data Available	Data Format	Data Source
9.2.1	Number, acres and distribution of private land management plans and percent of private ownership with management plans **Gauge**	Statewide by county Acreages available by ownership type. Forest industry, NIPF, clubs, other business, other Private Preserves – land trusts including The Nature Conservancy Tree Farm Plans USFWS cost share programs DEQ – Wetlands Mitigations CiWPIS – Coastal Inland Waterway Permit System, Contact DEQ Lansing and Field Staff Remedial Action Plans for AOC Storm water management: GVSU/MSU Institute for Water Resources and 3.1.1 LIP – Landowner Incentive Program, MDNR Wildlife Division 906-226-1325 - Marquette	Management plans are generally paper copies Owners with legal descriptions in electronic spreadsheet. Digital shape files of CFP ownership by county. Databases	Commercial Forest Land Plans for Sustainable Forestry, CFA Asst., MDNR FMFMD, 517-373-1277 DNR, FMFM and DIT Phone: 517.335.3210 NRCS Programs – CRP, WHIP, EQIP, WRP Phone:517.324.5259 http:/prmsreports.nrcs.usda.gov go to item 9, county reports. Lists acres by technical practice codes. Farm Service Programs – CRP tree planting, SIP 517.324.5106 Conservation Reserve Enhancement Program (CREP), MDA 517.373.9798 Forest Land Enhancement Program Phone: 517.335.3355 MDNR Official DEQ, LWMD Data Base Hard Copy Files Stored at the DEQ Field Offices for 3- 5 years Tree Farm / Mead/West Vaco MDNR/Fish Division – Inland Fisheries Grants

Indicator 9.2 Stewardship

Proposed Metric	Data Available	Data Format	Data Source
9.2.2 Miles of Great Lakes shoreline, inland lakes and water courses under special management **Gauge**	Statewide, region, local coverage	Collection methods/protocols Frequency of collection or updates. Paper Electronic File type (e.g. MS Excel) Digital files for GIS?	Lake Associations MDNR-Fisheries, Newberry OSC Phone: 906.293.5131 Gulliver Lake Assn., Indian Lake Assn., McDonald Lake Assn., Milakokia Lake Assn. Hiawatha Sports Club (Millecoquins Lake Assn.) USFS Private industrial land owners
9.2.3 Number and location of conservation easements in EUP **Gauge**	Biological Conservation Data (Advanced Revelations). Extensive biological information on parcels.	Electronic data Excel Spreadsheet Paper files GIS .	Farmland Preservation Program (PA 116 and PA 451 parts 361 and 362) MDA, 517.335.3466 Forest Legacy Program MDNR, Lansing 517.335.3351 The Nature Conservancy (TNC) 906.225.0399 Central Lake Superior Land Conservancy (CLSLC) 906.226.2461 Little Traverse Conservancy (LTC) 231.347.0991 Michigan Nature Assn (MNA) 517-655-5655 www.michigannature.org
9.2.4 Number of cooperative planning "agreements" across ownerships in EUP **Gauge**	Clay Lake Plains Plan Two Hearted River Watershed Plan Lex Cheneaux Economic Forum Munuscong Watershed Plan St. Mary's River Plan	Paper MS Excel	Eastern UP Partners in Ecosystem Management (EUPPEM) MDNR Field Offices; MDNR Operations Service Center Remedial Action Program, MDNR Fish Division

Indicator 9.2 - Stewardship

Proposed Metric	Data Available	Data Format	Data Source

9.2.5 Land use patterns across all ownerships **Gauge**	Land use and land cover data sets, including pre-settlement vegetation and wetland delineation.	1978 MIRS Land Use data available by county –vector image 1991 LANDSAT Thematic Mapper Imagery UP wide- raster image	MDNR

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 9 Ownership Patterns

The pattern and distribution of ownership and use of lands in the Eastern Upper Peninsula (EUP), plays a role in sustainable resources. Land ownerships can affect management options, resource demand and fragmentation. The

success of sustainable management of Michigan's resources depends on making connections across disciplines, interest, boundaries and landscapes.

Indicator 9.3 Accessibility

The extent to which a parcel or area of land can be reached and used by people.

Proposed Metric	Data Available	Data Format	Data Source
9.3.1 Percent of public and private land in the EUP **Gauge**	Maps; records on statewide, regional, local lands	LOTS; paper records; maps	MDNR Land Ownership Data Base; County Road Commission; MDOT; USFWS; NPS; USFS
9.3.2 Number and location of easements across public lands **Lever**	Records on state easements granted and acquired	LOTS; paper records; maps	MDNR Land Ownership Data Base; County Road Commission; MDOT; USFWS; NPS; USFS
9.3.3 Number and location of easements across private lands **Lever**	Records on state easements granted and acquired	LOTS; paper records; maps	MDNR Land Ownership Data Base; County Road Commission; MDOT; USFWS; NPS; USFS
9.3.4 Number of acres of public land without access (landlocked by private ownerships) **Gauge**	Maps; state land holdings	LOTS; paper records; maps	MDNR Land Ownership Data Base; County Road Commission; MDOT
9.3.5 Number of acres of private land enrolled in the Commercial Forest Program (CF) **Gauge**	Record w/ CFM foresters and Lansing FMFMD	LOTS; paper records	MDNR Land Ownership Data Base

Indicator 9.3 Accessibility

Proposed Metric	Data Available	Data Format	Data Source
9.3.6 Existence of a road maintenance plan and expenditures by agency **Lever**	LOTS for general planning; MAIN for FMFMD expenditures; DMB for MDOT expenditures	Maps; fiscal reports	MDNR local units and Lansing FMFMD; County Road Commission; MDOT

9.3.7 Miles of road by use class, distribution and density in the EUP **Gauge**	Road systems in EUP	Maps	MDNR local units and Lansing FMFMD; County Road Commission; MDOT

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 10 Economic Health:

A wide range and services are derived from our natural resources that create opportunities for economic stability in the Eastern Upper Peninsula. In addition to traditional forest products sector, the resource base supports mining, commercial fishing and an ever-growing tourist and recreation industry.

Indicator 10.1 Local and community economic health and trends

Proposed Metric	Data Available	Data Format	Data Source
10.1.1 Number of local economic development plans in the EUP Eco-Region **Gauge**	Local economic development plans that include a natural resource component	Type(s) of resources identified; Description(s) of *how* these resources are incorporated into local economic development	EUP Regional Planning and Development Commission 2002 Comprehensive Economic Development Strategy); UP Economic Development Alliance (
10.1.2 Describe job/income / employment / retirement data **Gauge**	Annual county-level data (some data also available at sub-county census tract level)	Electronic by county (generally, 2-4 years out-of-date.	http://www.michigan.gov/census/ _____ incorporates County Business Patterns & other demographic data
10.1.3 Contribution of the resource use to gross domestic product (GDP) of all sectors of the economy **Gauge**	EUP and County, available every 5 years (corresponds to economic census) or decades (both lag 2-4 years)	Should probably use several anecdotal and quantitative measures and trend data.	See above for quantitative data. See Dec. '99 MSU Report, "The Role of Natural Resources in Community and Regional Economic Stability in the Eastern Upper Peninsula."

Indicator 10.1 Local and community economic health and trends

Proposed Metric	Data Available	Data Format	Data Source

10.1.4 Diversity of forest economic activity **Gauge**	Changes over decades with emphasis on most recent years – by EUP and County or sub-EUP patterns. State, State Forest and some EUP data.	Establishments, Sales (can be used with a variety of diversity measures) Quantified level of Activity Qualitative/anecdotal synthesis of trends (mostly rec focus)	Econ. & Ag Census, also recreation trend as reflected in changes in food & lodging sectors over time (for diversity measures, see Dec 99 EUP MSU Research Report bibliography or FMFM Pedersen) Rec activity, from '99 Rec & Trails Assessment (FMFM) SCORP 2003 Appendix A
10.1.5 Measure change in the tax base **Gauge**	Annual township & county (past data available for trends)	SEV or Taxable Valuation data (also ag, comm, ind breakdowns available) in report or electronic format (e.g. CDs)	MI Dept. of Treasury State Tax Commission County Equalization Department
10.1.6 Capital outlay and investment trends **Gauge**	Sector data by state (sometimes county) every 5 Years (1997 is out; 2002 will be available in 2004-5) Names of major firms and trends reported Nature of and Approximate amounts by firm	Dollars invested Same as #1 May be in terms of outputs, employment generated or jobs saved, etc.	http://www.census.gov/epcd/www/econ97.html (update/contrast to national trends with Annual Survey of Manufacturers and/or Annual Capital Expenditures Survey) Some detailed data in County Reports, available locally and through: http://medc.michigan.org/miInfo/Places/Advanced/ Direct calls to local firms

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 10 Economic Health

A wide range of services are derived from our natural resources that create opportunities for economic stability in the Eastern Upper Peninsula. In addition to traditional forest products sector, the resource base supports mining, commercial fishing and an ever-growing tourist and recreation industry.

Indicator 10.2 Non-timber economic benefits

Proposed Metric	Data Available	Data Format	Data Source
10.2.1 Number of jobs/economic activity (e.g. indirect service jobs, recreation/tourism, and rec. equipment) **DIFFICULT TO MEASURE BUT MEASURABLE** **Gauge**	Census occupation categories: Statewide coverage to Block Group	Forestry, fishing & hunting; Mining; Retail trade; Real estate, rental & leasing; Arts, entertainment, & recreation; Accommodation & food services; Public administration in tabular format	Census 2000 summary file 3 (SF 3) *National Survey of Fishing, Hunting and Wildlife (*Michigan) Associated Recreation (USFWS)
10.2.2 User days/activity **DIFFICULT TO MEASURE BUT MEASURABLE** **Gauge**	Total number of visitors participating in general activities (dining, sightseeing, gambling, visiting beachfront, etc); Mean & median travel spending per person per day	UP Leisure Travel Profile (2001) —monthly mail surveys in tabular format	Michigan 2001 Travel Summary by D.K. Shifflet & Associates for Travel Michigan
10.2.3 Motel occupancy rates **DIFFICULT TO MEASURE BUT MEASURABLE** **Gauge**	Total number of units in commercial lodging; Room assessment revenue per year	Tabular data by county; Tabular data by CVB	Michigan County Tourism Profiles—Travel, Tourism & Recreation Resource Center; Travel Michigan Economic Impact Reports

Indicator 10.2 Non-timber economic benefits

Proposed Metric	Data Format	Data Availability	Data Source

10.2.4 Mean and median travel spending per person per day per activity **Gauge**		Frequency of participation in gathering, wildlife viewing, bird watching, hiking, camping, boating, fishing, hunting	Mail survey of Michigan residents in 2002; ordinal scale 1=never, 2=rarely, 3=sometimes, 4=frequently	2002 Resource attitudes in Michigan Survey by A. Mertig (MSU Department of Fisheries & Wildlife)
10.2.5 Total expenditures by individuals per activity in EUP **Gauge**		Nelson's survey circa 2000	Monthly mail surveys for UP and statewide coverage in tabular format	Michigan 2001 Travel Summary by D.K. Shifflet & Associates for Travel Michigan *National Survey of Fishing, Hunting and Wildlife (*Michigan) Associated Recreation (USFWS

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criterion 10 Economic Health:

A wide range of services are derived from our natural resources that create opportunities for economic stability in the Eastern Upper Peninsula. In addition to traditional forest products sectors, the resource base supports mining, commercial fishing and a growing tourist and recreation industry.

Indicator 10.3 Timber and Wood Products

Proposed Metric	Data Available	Data Format	Data Source
10.3.1 Timber volume, growth and mortality **Gauge**	Annual; both FIA & IFMAP will include all ownerships at county & above; IFMAP will have more intensive coverage of State Forests	Electronic databases with periodic reports; IFMAP integrated with other data layers in GIS system, allowing overlay of current forest conditions with past & future expected & other variables.	- USDA Forest Service, N.C.R.S. FIA Program - MI DNR FMFM IFMAP - (also Hiawatha NF db available)
10.3.2 Timber harvest by species **Lever**	For all ownerships at county level: Biennial for timber production output (but publishing lags by ~ 4 yrs.) Resource Planning Assessment = 1997 & '02 available. Continuous State Forest (and Hiawatha N.F.) estimates available at stand level & above.	Surveys of wood-using mills since 1984 serve as the basis of North Central Research Station (NCRS) timber product output (tpo) estimates and reports (a variety of tables & data available). State Forest timber sale program to be available in GIS format & integrated with inventory data.	- USDA Forest Service, N.C.R.S. FIA Program - RPA est at: _____ product output/wc_rpa_tpo.ASP **2** MI DNR FMFM VMS (also Hiawatha NF est. available
10.3.3 Legal and physical accessibility. Limit on timber availability for reasons of policy, legality, management decisions and physical access. **CANNOT BE DONE**	Public lands available as needed. CF: Annually (or as needed) by county for private lands as reflected in CF program. State Forest limitations on accessibility by entry year.	- Public lands in GIS/electronic format. - CF Electronic db of parcels (summed at township & county level). Contrast to FIA data on total private acres. - List of reserved lands to be compiled. - Stand attributes in OI/IFMAP	- SIRC (Hiawatha NF) - Commercial Forest (CF) lands program (FMFM-Lansing) - Reserved lands by type: e.g. Federal & State Parks, other designations (OI Stnd Cond. 8) - Local (FMU) knowledge of conditions precluding accessibility (e.g. OI limiting factors)

Indicator 10.3 Timber and wood products

Proposed Metric	Data Available	Data Format	Data Source
10.3.4 Wood product summary **Gauge**	Timber sale data available continuously from State by stand, annually from Hiawatha N.F., biennially from tpo for all ownerships by county	Electronic by product, species & location.	FMFM – Lansing (timber sale program, Forest Resource Mgmnt Section)
10.3.5 Determine ratio of harvest to growth by volume, species and products **Lever**	Available as needed/requested for State Forest (and, perhaps, Hiawatha N.F; other ownerships dependent upon annualized FIA data & tpo updating	Public Lands have inventory and timber sale dbs, allowing calculation as needed. Dependent upon FIA and tpo data for other owners. FIA data adequate in 2004-5, tpo data has lagged by ~4 yrs.	FMFM (cooperatively by Lansing and EUP Timber Management Spec.) Forest Service for tpo and FIA data.

10.3.6	10.3.7	10.3.8	10.3.9
10.3.10 Net difference between growth and harvest by species. **Lever**	(same as previous metric above)	(same as previous metric above)	(same as previous metric above)
10.3.11 Number of jobs/economic activity (e.g. logging, hauling, and mills) **Gauge**	Available by county annually (for most federal data), monthly (for some state data), or periodically (Wood Products db)	Electronic tables or dbs. Some federal data may be relatively aggregated or not disclosed due to few firms.	1) MI Dept. of Career Dev./Office of Labor Market Info 2) US BLS – Cnty Bus. Patterns & US Census: http://censtats.census.gov 3) Wood Products DB – MI DNR http://www.michigandnr.com/wood/

10.3.8 Wood budget – how much wood going out of the area **Gauge**	If tpo estimates used, may be several years out-of-date; direct survey to supplement/update	Electronic data summed for EUP (some processing required)	1) Tpo estimates – NCRS 2) State Forest & Hiawatha NF timber sale estimates 3) Survey of major EUP mills, FMFM forestry personnel

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criteria 11 Institutional Processes

Institutional processes address the legal and institutional framework for the application of ecosystem management. They address the policies, legislation, regulations and guidelines that drive and direct ecosystem practices, and direct how institutions cooperate with others in the application of ecosystem management. Processes examine the quality and quantity of opportunities for public involvement in ecosystem planning leading to resource decisions.

Indicator 11.1 Legal Framework for Ecosystem Management

The framework should include the existence and/or application of laws, regulations, policy and guidelines for land management. Also, the framework should consider and meet legal obligations with respect to duly established Native American treaty rights.

Proposed Metric	Data Available	Data Format	Data Source

11.1.1 Land management laws and regulations. **Lever**	Public Act 451 of 1994 Articles I – III Administrative Rules R299.901,R2992601, R299.921, R322.2.1 Land Use Orders of the Director 36 CFR Part 219	Word files Word files Word files Word files	Internet & Intranet www.michigan.gov/dnr/laws & legislation Internet & Intranet www.michigan.gov/dnr/laws& legislation Internet & Intranet Internet

Indicator 11.1 Legal framework for ecosystem management

Proposed Metric	Data Available	Data Format	Data Source
11.1.2 Wildlife management laws and regulations. **Lever**	Public Act 451 of 1994 Articles I & III; Director's Order; Administrative Rules R299.1021; The Wildlife Commission Order Part 50 CFR	Word files Word files Word files Word files	Internet & Intranet www.michigan.gov/dnr/laws& legislation Internet & Intranet www.michigan.gov/dnr/laws& legislation www.michigan.gov/dnr/laws& legislation Internet
11.1.3 Recreation laws and regulations. **Lever**	Public Act 451 of 1994 Article III Chapter 4	Word files	Internet & Intranet www.michigan.gov/dnr/laws& legislation

11.1.4 Fisheries management laws and regulations. **Lever**	Public Act 451 of 1994 Article III; Director's Order Administrative Rules R299.701 Part 50 CFR	Word files Word files Word files	Internet & Intranet www.michigan.gov/dnr Internet & Intranet www.michigan.gov/dnr Internet
11.1.5 Native American treaty rights. **Lever**	Treaty of 1836	Printed Copy	District Law Supervisor
11.1.6 Department & Division Policies and Procedures **Lever**	Available by Department and Division.	Word files.	DNR Intranet.
11.1.6 Compliance with land management laws, regulations, policies and guidelines (LRPGs). **Gauge**	New (supplementing existing LED tracking)	Other than existing LED reporting, narrative/qualitative description of relevant LRPGs compliance	Division assessments

Eastern Upper Peninsula Eco-Region Indicator Worksheet

Criteria 11 Institutional Processes

Institutional processes address the legal and institutional framework for the application of ecosystem management. They address the policies, legislation, regulations and guidelines that drive and direct ecosystem practices, and directs how institutions cooperate with others in the application of ecosystem management. Processes examine the quality and quantity of opportunities for public involvement in ecosystem planning leading to resource decisions.

Indicator 11.2 Institutional Framework

The framework should include the existence of audit or assessment programs, the existence of an integrated planning system and incorporate fair and effective decision making.

Proposed Metric	Data Available	Data Format	Data Source

11.2.1 Public participation in the design of decision-making processes **Gauge**		Attendance sheets from meetings; e-mail, personal letters, web site	Meeting sponsor; number of web site hits
11.2.2 Public participation in decision-making processes **Gauge**		Attendance sheets from meetings, e-mail, personal letters, web site	Meeting sponsor; number of web site hits
11.2.3 Public participation in implementation of decisions and monitoring **Gauge**		Attendance sheets from meetings and participation in project implementation and project monitoring, e-mail, personal letters, web site	Meeting sponsor and/or person/group responsible for specific project that is being implemented and/or monitored, number of web site hits

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Criteria 11 Institutional Processes

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Indicator 11.3 Balance between different values

This indicator is to ensure that values identified as being important in the Eastern Upper Peninsula Eco-Region are not eliminated and that a dispute resolution policy be established to ensure balance between the values.

Proposed Metric	Data Available	Data Format	Data Source

11.3.1 Amount of management effort/interest put into different values **Gauge**	Accounting procedures for time and expenditures	Excel	Metrics in other indicators; MDNR Divisions/Bureaus/Offices
11.3.2 Annual evaluation and reporting of the eco-system management effort in maintaining the values on the landscape and appropriate adjustments made. **Gauge**	From metrics in other indicators		Annual analysis and report of Criteria and Indicators.
11.3.3 Application and effectiveness of dispute resolution guidelines/policy **Lever**	Draft from EUP Eco-team	Word	EUP Eco-team; Department documents

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Criteria 11 Institutional Processes

Institutional processes address the legal and institutional framework for the application of ecosystem management. They address the policies, legislation, regulations and guidelines that drive and direct ecosystem practices, and direct how institutions cooperate with others in the application of ecosystem management. Processes examine the quality and quantity of opportunities for public involvement in ecosystem planning leading to resource decisions.

Indicator 11.4 Resources allocated for ecosystem management values.

Proposed Metric	Data Available	Data Format	Data Source

11.4.1 Resources allocated within the Department for ecosystem management planning, implementation and monitoring **Gauge**	Statewide for Fish, Law Enforcement, Wildlife, Parks and Recreation and Forest Mineral and Fire Management Division	Coding blocks maintained as Excel spreadsheets Division budget information	Managers of Financial Services Unit for each division.
11.4.2 Participation in external planning efforts (e.g. National Forest Plan revisions) **Gauge**	Same as above	Same as above	Other agency plans reviewed EUPPEM
11.4.3 Expenditure of resources and dedicated funds for "on the ground" projects **Lever**	Same as above	Same as above	Eco-team project ranking process